

CLAIMS :

1. A method of building a variable length error code, said method comprising the steps of :

(1) initializing the needed parameters : minimum and maximum length of codewords  $L_1$  and  $L_{\max}$  respectively, free distance  $d_{\text{free}}$  between each codeword (said distance  $d_{\text{free}}$  being for a VLEC code C the minimum Hamming distance in the set of all arbitrary extended codes), required number of codewords S ;

(2) generating a fixed length code C of length  $L_1$  and minimal distance  $b_{\min}$ , with  $b_{\min} = \min \{b_k ; k = 1, 2, \dots, R\}$ ,  $b_k$  = the distance associated to the codeword length  $L_k$  of code C and defined as the minimum Hamming distance between all codewords of C with length  $L_k$ , and  $R$  = the number of different codeword lengths in C, said generating step creating a set W of n-bit long words distant of d ;

(3) storing in the set W all the possible  $L_1$  – tuples distant of  $d_{\min}$  from the codewords of C (said distance  $d_{\min}$  for a VLEC code C being the minimum value of all the diverging distances between all possible couples of different-length codewords of C), and, if said set W is not empty, affixing at the end of all words one extra bit, said storing step replacing the set W by a new one having twice more words than the previous one and the length of each one of these words being  $L_1 + 1$  ;

(4) deleting all the words of the set W that do not satisfy the  $c_{\min}$  distance with all codewords of C, said distance  $c_{\min}$  being the minimum converging distance of the code C ;

(5) in the case where no word is found or the maximum number of bits is reached, reducing the constraint of distance for finding more words ;

(6) controlling that all words of the set W are distant of  $b_{\min}$ , the found words being then added to the code C ;

(7) if the required number of codewords has not been reached, repeating the steps (1) to (6) until the method finds either no further possibility to continue or the required number of codewords ;

(8) if the number of codewords of C is greater than S, calculating, on the basis of the structure of the VLEC code, the average length AL obtained by weighting each codeword length with the probability of the source, said AL becoming the  $AL_{\min}$  if it is lower than  $AL_{\min}$ , with  $AL_{\min}$  = the minimum value of AL, and the corresponding code structure being kept in memory ;

said building method being moreover characterized in that the deletion is done not only in the last obtained group but also in the group of a given length value and, denoting by  $L_s$  the length of the code to which the method skips back at the end of the deletion step, the beginning of the best VLEC structure of each  $L_s$  is kept in memory and re-used within the next search for  $L_s' = L_s + 1$ .

2. A method of building a variable length error code, said method comprising the steps of :

(1) initializing the needed parameters : minimum and maximum length of codewords  $L_1$  and  $L_{\max}$  respectively, free distance  $d_{\text{free}}$  between each codeword (said distance  $d_{\text{free}}$  being for a VLEC code  $C$  the minimum Hamming distance in the set of all arbitrary extended codes), required number of codewords  $S$  ;

(2) generating a fixed length code  $C$  of length  $L_1$  and minimal distance  $b_{\min}$ , with  $b_{\min} = \min \{b_k ; k = 1, 2, \dots, R\}$ ,  $b_k$  = the distance associated to the codeword length  $L_k$  of code  $C$  and defined as the minimum Hamming distance between all codewords of  $C$  with length  $L_k$ , and  $R$  = the number of different codeword lengths in  $C$ , said generating step creating a set  $W$  of  $n$ -bit long words distant of  $d$  ;

(3) storing in the set  $W$  all the possible  $L_1$  - tuples distant of  $d_{\min}$  from the codewords of  $C$  (said distance  $d_{\min}$  for a VLEC code  $C$  being the minimum value of all the diverging distances between all possible couples of different-length codewords of  $C$ ), and, if said set  $W$  is not empty, affixing at the end of all words one extra bit, said storing step replacing the set  $W$  by a new one having twice more words than the previous one and the length of each one of these words being  $L_1 + 1$  ;

(4) deleting all the words of the set  $W$  that do not satisfy the  $c_{\min}$  distance with all codewords of  $C$ , said distance  $c_{\min}$  being the minimum converging distance of the code  $C$  ;

(5) in the case where no word is found or the maximum number of bits is reached, reducing the constraint of distance for finding more words ;

(6) controlling that all words of the set  $W$  are distant of  $b_{\min}$ , the found words being then added to the code  $C$  ;

(7) if the required number of codewords has not been reached, repeating the steps (1) to (6) until the method finds either no further possibility to continue or the required number of codewords ;

(8) if the number of codewords of  $C$  is greater than  $S$ , calculating, on the basis of the structure of the VLEC code, the average length  $AL$  obtained by weighting

each codeword length with the probability of the source, said AL becoming the  $AL_{\min}$  if it is lower than  $AL_{\min}$ , with  $AL_{\min}$  = the minimum value of AL, and the corresponding code structure being kept in memory ;

said building method being moreover characterized in that at most one bit is added

5

at the end of each word of the set W, the deletion is done not only in the last obtained group but also in the group of a given length value and, denoting by  $L_s$  the length of the code to which the method skips back at the end of the deletion step, the beginning of the best VLEC structure of each  $L_s$  is kept in memory and re-used within the next search for  $L_s' = L_s + 1$ .

10

3. A device for carrying out a variable length error code building method according to anyone of claims 1 and 2.